

## **D0 Excerpt from April 2002 PAC Recommendations**

**Run IIb Upgrades** P-924 CDF (Bedeschi/Goshaw) P-925 D0 (Weerts/Womersley)

### **Overall Comments**

The Committee was impressed with the progress made by CDF and D0 since the November PAC meeting. The dialogue between the collaborations and the recently formed Technical Review Committee (TRC) provided a forum to explore the most urgent cost, schedule, manpower, and technical issues. The report of the committee offered numerous recommendations, to which the collaborations have recently provided written responses, and as a result of which some design changes have been adopted. Despite these encouraging signs, the Committee remains seriously concerned by the scope of challenges that remain and the difficulty posed by the as-yet unresolved tension between the simultaneous demands of physics performance, resource limitations, and schedule. The Laboratory and the two collaborations *must work hand-in-hand* to maximize the combined potential for discovery of new physics in Run IIb by optimizing the use of constrained Laboratory resources, both manpower and financial.

At the Aspen meeting in June, the Committee will reconvene to consider a recommendation for Stage I approval of the upgrade projects. This process will require new or refined information on various aspects of the proposed upgrades, which will be noted in the paragraphs that follow. More broadly, in presentations at the Aspen meeting, the Committee would like to hear from each collaboration a critical evaluation of progress with respect to plans that were presented at the November 2001 PAC. In the case of the additional CDF upgrade components whose inclusion in the scope is most in question, this discussion should include latest feasible dates for a decision on implementation. Above all, the Committee will be looking to see the Laboratory and the collaborations converge on a baseline plan that is shown quantitatively to be consistent with the primary physics goals.

The Committee is encouraged that the projects are moving toward Stage I approval and baselining this summer. The Committee would appreciate an overview of the high-level project milestones for all items of the upgrade projects at the Aspen meeting.

### **The Silicon Upgrades**

For both CDF and D0, the silicon tracker upgrades are essential to the ultimate success of the physics program and are the schedule and cost drivers for the Run IIb upgrade projects. Both experiments have made significant progress in optimizing the design of their silicon trackers since the November PAC meeting.

## D0

The Committee notes that D0 has moved forward in several areas, including design of almost all components, procurement of prototype sensors, cables, hybrids, and other key items, R&D on flex cables, and mechanical design and prototyping of the inner two layers. The collaboration's response to the TRC report was restrained, however, and included many items that were identified as "works in progress." The Committee looks forward to seeing at Aspen the results of several investigations that are under way or being planned.

## Both

The collaborations have assessed a number of descope options. For example, the effect of eliminating a silicon layer was presented by both collaborations in terms of b-tagging efficiency, which directly impacts Higgs sensitivity. The CDF upgrade TDR showed that elimination of an outer layer, which would result in a significant reduction of 27-30% in the number of staves, would reduce b-tagging efficiency by 4% relative to the efficiency with all layers. This increases to 13% if the inner COT layers are dead\*. The D0 presentation showed that eliminating Layer 4, which would result in a significant cost reduction of \$1.15M, would reduce double b-tag efficiency by 12-14% relative to the efficiency with all layers.

In light of remaining shortfalls in resources and the extremely tight construction schedule, and in order to retain nearly the full scope of their proposed upgrades, the collaborations should continue to search for cost reductions and for simplifications that would shorten construction time. Estimates of potential cost savings, time savings, and effects on Higgs sensitivity should be quantitative. The justifications to retain scope may include redundancy arguments; however, these arguments should be quantitative, in terms of the usual Higgs metric.

The Committee notes the delay incurred in the submission of the first prototype SVX4 chip, and will look forward to an update on the status of this part of the project at Aspen. The Committee also notes that both collaborations have rejected the TRC's suggestion to use edge alignment during ladder production; the Committee accepts this conclusion.

## Non-silicon Upgrades

In anticipation of higher rates and occupancies in the Run IIb era, both experiments are proposing upgrades to their Trigger and Data Acquisition systems, and CDF has introduced for consideration some further detector upgrades.

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\* The CDF study was performed using the Run I silicon geometry.

D0

For D0, trigger upgrades are essential to the ultimate success of the D0 Run IIb physics program. Proposed upgrades are:

1. *Level 1 Trigger.* The sum of projected Level 1 output rates at Run IIb luminosities for four example physics channels was shown to be 77kHz, well in excess of the 5kHz input capacity of Level 2. Proposed upgrades include a tracking trigger upgrade (narrowing roads from double to single fibers), a calorimeter trigger upgrade (involving signal filtering to reduce pile up and clustering to sharpen energy thresholds), and higher resolution calorimeter-track matching. In combination these should bring the Level 1 output rate for the four example channels down to 3.7kHz; no one trigger improvement alone suffices to reach this level. While the calorimeter trigger is the most costly component of this package, experimenters argued that the more sophisticated cluster calculation gains a factor of three rejection for constant efficiency when compared against a simple alternative of raising tower thresholds. The Committee, in concurrence with the TRC, judges an upgrade of the Level 1 trigger to be essential and looks forward to progress reports at Aspen.
2. *Level 2 Trigger.* The collaboration proposes an upgrade of processors for Level 2, and an upgrade of the Silicon Track Trigger to take full advantage of the expanded silicon detector. The latter is expected to permit a sharper momentum threshold and a lower fake rate. The Committee was not shown details, however, and looks forward to more complete presentations at Aspen, notably on progress in understanding whether the more limited STT upgrade option will be adequate.
3. *Other.* DAQ upgrade and SIFT chip replacements were not discussed at this meeting.

**Committee requests to CDF and D0**

1. Overview of high-level project milestones.
2. Progress with respect to plans and milestones presented at November 2001 PAC.
3. Dates for decision to implement/descope trigger modifications.
4. Report on cost-reduction/simplification efforts for silicon detectors.
5. D0: Detailed evaluation of Silicon Track Trigger update options.

